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Simulation of rarefied low pressure RF plasma flow around the sample

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Abstract

© Published under licence by IOP Publishing Ltd. The paper describes a mathematical model of the flow of radio frequency plasma at low pressure. The hybrid mathematical model includes the Boltzmann equation for the neutral component of the RF plasma, the continuity and the thermal equations for the charged component. Initial and boundary conditions for the corresponding equations are described. The electron temperature in the calculations is 1-4 eV, atoms temperature in the plasma clot is (3-4) • 10 3 K, in the plasma jet is (3.2-10) • 10 2 K, the degree of ionization is 10 -7 -10 -5 , electron density is 10 15 -10 19 m -3 . For calculations plasma parameters is developed soft package on C++ program language, that uses the OpenFOAM library package. Simulations for the vacuum chamber in the presence of a sample and the free jet flow were carried out.

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References

[1] Abdullin I S, Zheltukhin V S, Sagbiyev I R and Shayekhov M F 2007 Modifikaciya Nanosloev v Vysokochastotnoj Plazme Ponizhennogo Davleniya (Kazan: Izdatel'stvo Kazanskogo Tekhnologicheskogo Universiteta)
[2] Khubatkhuzin A A, Abdullin I S, Gatina E B, Zheltukhin V S and Shemakhin A Y 2012 Vestn. Kazan. Tekhnol. Univ. 15 72
[3] Khubatkhuzin A A, Abdullin I S, Bashkirtsev A A and Gatina E B 2012 Vestn. Kazan. Tekhnol. Univ. 15 71
[4] Dulov V G and Lukyanov G A 1984 Gazodinamika Processov Istecheniya (Moscow: Nauka)
[5] Mitchner M and Kruger C H 1973 Partially Ionized Gases (New York: John Wiley and Sons)
[6] Bird G A 1976 Molecular Gas Dynamics and the Direct Simulation of Gas Flows (Oxford: Clarendon Press)
[7] Zheltukhin V S and Shemakhin A Y 2011 Uch. Zap. Kazan. Univ., Ser. Fiz.-Mat. Nauki 4 135
[8] Zheltukhin V S and Shemakhin A Y 2014 Math. Model. Comput. Simul. 6 101
[9] Abdullin I S, Zheltukhin V S, Khubatkhuzin A A and Shemakhin A Y 2014 Matematicheskoe Modelirovanie Gazodinamiki Strujnykh Techenij Vysokochastotnoj Plazmy Ponizhennogo Davleniya (Kazan: Izdatel'stvo Kazanskogo Tekhnologicheskogo Universiteta)
[10] OpenFOAM OpenFOAM Foundation Free Open Source CFD 2011-2016 http://www.openfoam.org - ref-separator